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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/597,129	07/12/2006	Anne Kristina Niemi	PHUS040040US2	6970
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EXAMINER FETZNER, TIFFANY A				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

**Application No.**

10/597,129

**Applicant(s)**

NIEMI ET AL.

**Examiner**

Tiffany A. Fetzner

**Art Unit**

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**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 20 December 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-8508)
- Paper No(s)/Mail Date \_\_\_\_\_

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

**DETAILED 2<sup>nd</sup> Non-final ACTION**

***Priority***

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. **Claim 1, and claims 2-7** as well as **new claim 17** which depend from **claim 1** are objected to under **35 U.S.C. 112, second paragraph**, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites the performing a calibration sequence **"relative to"** the parallel imaging sequence, but the term **"relative to"** is undefined. **"relative how?"** **"relative in what way?"** The examiner cannot determine the scope of the relationship between the parallel imaging sequence and the calibration sequence.
4. **The applied art below has been applied based on the examiner's attempt to apply the word "relative"** to the claims, given the 112 problems which are present.
5. These claims are also rejected under **35 U.S.C. 112, second paragraph**, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are the actual relationship of the calibration sequence to the parallel imaging sequence. Do they occur at the same time?, Does one occur before the other? For purposes of applying prior art the examiner is making the assumption that the calibration sequence is being applied in "conjunction with" the parallel imaging sequence.
6. **Claim 4** is also objected under **35 U.S.C. 112, second paragraph**, because in **claim 4**, the phrase "very short" is an undefined term of degree or scope additionally the qualifier of "e.g. less than 5 ms" also renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See

MPEP § 2173.05(d). If applicant means to recite that “the echo time of the gradient echo type calibration sequence is less than 5ms which is considered to be very short”, then claim 4 should state it in a definite, non-ambiguous manner.

***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

8. **Claims 1-7** are rejected under **35 U.S.C. 102(a)** as being anticipated by **Zhu et al.**, US Patent 7,009,396 B2 issued March 7<sup>th</sup> 2006 in view of **Watkins et al.**, US patent 6,492,814 issued Dec. 10<sup>th</sup> 2002.

9. With respect to **Claim 1**, the **Zhu et al.**, article teaches a ‘method of improved coil sensitivity estimation for reducing artifacts in an MRI apparatus utilizing parallel imaging’ [See col. 5 line 6 through col. 9 line 20] “the method comprising: for a parallel imaging sequence, performing a calibration sequence **relative to?** the parallel imaging sequence,” (i.e. See the additional phase or frequency offset which is added to each of the parallel acquired regional images to account for the continuous motion of the table. See col. 6 line 8-67] “using one of: a spin echo type sequence matching the in-plane phase encode direction of the calibration and the parallel imaging sequences for each calibration; and a gradient echo type sequence matching the in-plane phase encode direction of the calibration and the parallel imaging sequences for each calibration” [See col. 8 line 28 through col. 9 line 10; col. 5 lines 35-42]

10. With respect to **Claim 2**, the **Zhu et al.**, teaches “the calibration sequence is performed for each parallel imaging sequence.” [See col. 8 lines 28-61] The same reasons for rejection, that apply to **claim 1** also apply to **claim 2** and need not be reiterated.

11. With respect to **Claim 3**, the **Zhu et al.**, also suggests “the calibration sequence” represents the additional phase or frequency offset for each receiver divided by the number of n receivers, which is performed prior to each said parallel imaging

sequence" because it is added to the acquired data during reconstruction." [See col. 6 lines 2-67.] The same reasons for rejection, which apply to **claims 1, 2** also apply to **claim 3** and need not be reiterated.

12. With respect to **Claim 4**, the **Zhu et al.**, article teaches [See col. 5 lines 50-57, where the table speed which is calibrated to frequency or phase change allows short periods of 4-8ms for data acquisition, therefore the **Zhu et al.**, article teaches that a phase or frequency calibration "is performed with a very short echo time, which encompasses (e.g. **less than 5 ms**)."] The same reasons for rejection, that apply to **claim 1** also apply to **claim 4** and need not be reiterated.

13. With respect to **Claim 5**, the **Zhu et al.**, article teaches the step of "using an essentially identical read out gradient in both the calibration sequence and the parallel imaging sequence" because either the phase or readout direction is parallel to the axis of table translation, and is adjusted commensurate with the translation of the table, with an additional calibrating offset of the FOV/N receivers added so that the signals can be distinguished. See col. 5 line 34 through col. 6 line 67.] The same reasons for rejection, that apply to **claim 1** also apply to **claim 5** and need not be reiterated.

14. With respect to **Claim 6**, the **Zhu et al.**, article shows from figures 1, 2, and 3 that "a phase encode direction of said calibration sequence is essentially directed in along a phase encode direction of said parallel imaging sequence." [See col. 5 lines 58-64 as one example]. The same reasons for rejection, that apply to **claim 1** also apply to **claim 6** and need not be reiterated.

15. With respect to **Claim 7**, the **Zhu et al.**, article teaches from col., 4 lines 47-63 and col. 9 lines 5-20 "an MRI apparatus having a sequence controller programmed to perform the method as set forth in claim 1]. The same reasons for rejection, which apply to any one of **claims 1-6** also apply to **claim 7** and need not be reiterated.

#### ***Claim Rejections - 35 USC § 103***

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

17. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

18. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

19. **Claims 8-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Zhu et al.**, US Patent 7,009,396 B2 issued March 7<sup>th</sup> 2006 in view of **Watkins et al.**, US patent 6,492,814 issued Dec. 10<sup>th</sup> 2002.

20. With respect to **Amended Claim 8**, the **Zhu et al.**, teaches An MRI apparatus" (i.e. the Magnetom Sonata) "that includes a magnet system for generating a B0 magnetic field in an examination zone"[See col. 2 lines 20-23], "~~the apparatus comprising:~~ means an RF system for exciting and manipulating magnetic resonance in the examination zone; [See col. 2 lines 25-50] means a gradient system for spatially encoding the magnetic resonance; [See col. 2 lines 23-25] a plurality of RF receive coils with differing sensitivity profiles for receiving resonance signals in parallel; [See col. 1 line 66-col. 2 line 12; col. 4 lines 43-46; col. 5 line 19 through col. 6 line 3; col. 8 line 28 through col. 9 line 20.] means a reconstruction processor for reconstructing received resonance signals into image representations; [See col. 4 lines 47-63, figure 1

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and its associated description in the text of **Zhu et al.**, ] means a calibration processor for generating sensitivity profiles of the coils from image representations generated during a calibration scan; [See col. 4 lines 47-63, figure 1 and its associated description in the text of **Zhu et al.**] means a reconstruction processor generating a diagnostic image from the sensitivity profiles and image representations generated during a diagnostic scan; [See figure 1] a sequence control means ~~for accessing~~ accesses a calibration sequence memory means to retrieve ~~one of~~ an RF refocused spin echo type sequence and ~~a gradient recalled echo type sequence~~ and controlling the ~~resonance exciting~~ means RF system and the ~~spatial encoding~~ means gradient system in accordance with the retrieved calibration sequence to generate resonance signals for the reconstruction means processor to reconstruct into the calibration image representations and ~~for accessing~~ accesses a diagnostic imaging sequence memory means to retrieve a diagnostic imaging sequence and controlling the ~~resonance exciting~~ means RF system and the ~~spatial encoding~~ means gradient system to generate resonance signals for the reconstruction means processor to reconstruct into the diagnostic image representations." [See figure 1 through 4 and col. 1 line 66 through col. 9 line 20 of the **Zhu et al.**, reference for the components and means by which each of the disclosed method steps are actualized on the MRI in the **Zhu et al.**, reference.

21. **Zhu et al.**, lacks directly teaching or showing that the MRI system is an open MRI magnet, however Watkins et al., shows an open Magnet in figure 1, and teaches using the same array type coils as disclosed by the **Zhu et al.**, reference, therefore It would have been obvious to one of ordinary skill in the art at the time that the invention was made that the use of a coil array system, with coil sensitivities in order to conduct parallel imaging can be performed on both Closed and Open style MRI systems. type of imaging procedure The same reasons for rejection, that apply to **claim 1** also apply to **claim 8** and need not be reiterated.

22. With respect to **New claim 9** **Zhu et al.**, teaches and shows "the sequence control retrieves a phase encode gradient direction from the diagnostic imaging sequence memory and causes the gradient system to apply a phase encode gradient during the calibration sequence which is in the retrieved phase encode direction." [See

col. 5 line 19 through col. 7 line 7, and col. 8 line 28 through col. 9 line 20 where data acquisition is acquired with table translation, where the receivers / channels acquire a coherent (i.e. in phase) k-space data matrix and subsequently a regional image or a series of regional images along (i.e. in line with) the translational direction. Additionally col. 5 line 58 through col. 6 line 3 teaches that the phase encode direction may be selected to be along the translational direction (i.e. parallel to the direction of table motion).] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 8** also apply to **claim 9** and need not be reiterated.

23. With respect to **New claim 10 Zhu et al.**, teaches and shows "the sequence control" [See figure 1] "retrieves a read gradient from the diagnostic imaging sequence memory and causes the gradient system to apply the retrieved read gradient to read out echo signals during the calibration sequence." [See col. 5 lines 42-57; col. 6 lines 4-67; col. 7 line 60 through col. 9 line 20, figure 4.] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 8, 9** also apply to **claim 10** and need not be reiterated.

24. With respect to **New claim 11 Zhu et al.**, teaches "the sequence control retrieves a read gradient" (i.e. a frequency encoding gradient) from the diagnostic imaging sequence memory and causes the gradient system to apply the retrieved read gradient to read out echo signals during the calibration sequence. [See col. 5 lines 35-57, col. 6 lines 4-67; col. 7 line 60 through col. 9 line 20, figure 4.] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 8** also apply to **claim 11** and need not be reiterated.

25. With respect to **New claim 12 Zhu et al.**, teaches "the sequence control applies a diagnostic imaging sequence other than a spin echo imaging sequence." [See col. 8 line 64 through col. 9 line 10.] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 8** also apply to **claim 10** and need not be reiterated.

26. With respect to **New claim 13 Zhu et al.**, teaches and shows "A magnetic resonance method comprising: prior to conducting a parallel imaging sequence in which resonance data is phase encoded in a selected phase encode direction and resonance



data is read out with a selected read gradient, conducting a calibration sequence including: generating a series of spin echoes; phase encoding the spin echoes in said selected phase encode direction;" [See col. 8 line 64 through col. 9 line 20] "generating sensitivity maps from the spin echoes;" col. 8 lines 28-50] "conducting the parallel imaging sequence to generate resonance data;" [See col. 5 lines 19-57] "reconstructing the resonance data into folded images; unfolding the folded images using the generated sensitivity maps." [See col. 1 line 66 through col. 2 line 12; ,col. 6 line 27 through col. 9 line 20] .] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1**, also apply to **claim 13** and need not be reiterated.

27. With respect to **New claim 14 Zhu et al.**, teaches "reading out the spin echoes using said retrieved parallel imaging sequence read gradient. [See col. 8 line 28 through col. 9 line 20 and col. 5 lines 35-57.] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 13** also apply to **claim 14** and need not be reiterated.

28. With respect to **New claim 15 Zhu et al.**, teaches "the parallel imaging sequence is a sequence other than a spin echo sequence." [See col. 8 line 67 through col. 9 line 10] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 13** also apply to **claim 15** and need not be reiterated.

29. With respect to **New claim 16 Zhu et al.**, lacks directly teaching that "the parallel imaging sequence and the calibration sequence are conducted in an examination region of an open MRI magnet system" because **Zhu et al.**, shows a closed MRI system, However Watkins et al., teaches this limitation, for the same reasons already set forth in the rejection of claim 8, that need not be reiterated. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 8, 13**, also apply to **claim 16** and need not be reiterated.

30. With respect to **New claim 17 Zhu et al.**, lacks directly teaching that "the method is performed in an examination region of an open magnet MRI system in which a B0 magnetic field rolls over relatively gradually at edges of a field of view which tends to cause phase errors". However, It would have been obvious to one of ordinary skill in the art at the time that the invention was made that the sinusoidal signal of Watkins et

al., figure 3, suggests that the static B0 magnetic field rolls over relatively gradually at edges of a field of view, because of its apodized form underneath the applied gradient.] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1**, also apply to **claim 17** and need not be reiterated.

31. With respect to **New claim 18 Zhu et al.**, teaches "using spin echoes which refocuses phase errors, effectively cancelling the phase errors", based on the teachings of col. 8 line 66 through col. 9 line 20 and the other text of the disclosure in general. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 17** also apply to **claim 18** and need not be reiterated.

32. With respect to **New claim 19 Zhu et al.**, teaches "using a gradient echo type sequence with a short echo time to minimize accumulated phase errors based on the teachings of col. 8 line 66 through col. 9 line 20 and the other text of the disclosure in general and the teaching that the frequency and phase of the pulses is changed commiserate with table motion in order to eliminate aliasing / ghosting errors.

#### ***Prior Art of Record***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

**A) ZHANG, Q., et al.**; Improving True-FISP Parallel Cine Imaging using a New Data-acquisition Scheme for Coil Sensitivity Calibration; 2003; Proc. Intl. Soc. Mag. Reson. Med.; 11:2329., which was supplied by the applicant's July 12<sup>th</sup> 2006 IDS statement and will be referred to hereafter as the **ZHANG et al.**, article.

#### ***Conclusion***

33. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday, Wednesday, and Friday-Thursday from 7:00am to 2:10 pm., and on Tuesday and Thursday from 7:00am to 5:30pm.

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34. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Diego Gutierrez**, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(571) 273-8300**.

35. Information regarding the status of an application may be obtained from the Patent Application information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PMR or Public PMR. Status information for unpublished applications is available through Private PMR only. For more information about the PMR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PMR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Diego Gutierrez/  
Supervisory Patent Examiner, Art Unit 2831

/TAF/  
May 1, 2008